



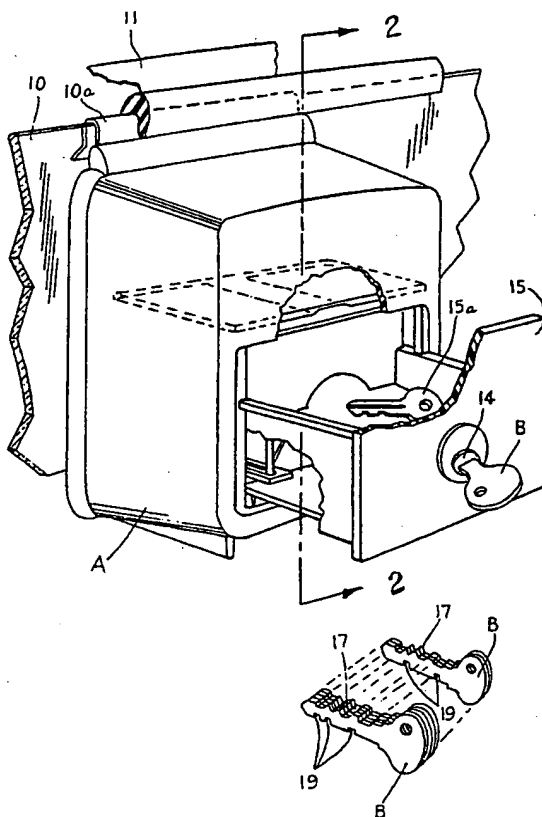
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US92/10589 (22) International Filing Date: 11 December 1992 (11.12.92) (30) Priority data: 07/807,259 13 December 1991 (13.12.91) US (71)(72) Applicants and Inventors: CARTER, Ronald, L. [US/ US]; 1 Chick Springs Road, #104, Greenville, SC 29609 (US). WALDRON, James, D. [US/US]; Rt. 3, Box 383, Leesburg, VA 22075 (US).	(81) Designated States: AU, BR, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published With international search report.	
(74) Agent: BAILEY, Ralph; Bailey & Hardaway, 125 Broadus Avenue, Greenville, SC 29601 (US).		

(54) Title: LOCK WITH KEY IDENTIFYING APPARATUS AND METHOD

## (57) Abstract

A lock having a plurality of keyed alike keys (B) each having like serrations (17) and each being encoded with notches (19) in an identifiable pattern to actuate light sensing detectors (25) for identifying each respective key (B). The lock has a first series of spaced apertures (20) in its body (21) as well as a second series of spaced apertures (22). When the lock is actuated in response to any one of the access keys (B), light from a source (24) passes through the first and second series of apertures (20, 22) when the notches (19) align therewith so that the detectors (25) provide a signal identifying which of the access keys (B) is being used to open the lock.



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## LOCK WITH KEY IDENTIFYING APPARATUS AND METHOD

## Background of the Invention

This invention relates to a lock, operable in response to each of a plurality of access keys, detecting which of  
5 the access keys is used in opening the lock.

The ability to keep a record of access to locked  
~~articles is desirable in many businesses. For example, in~~  
~~many instances it is important to keep certain items or~~  
areas restricted to only those persons possessing an access  
10 key. It is also desirable to keep track of which  
individuals have gained access, especially when a large  
number of like keys are in simultaneous use.

This problem has been addressed through the use of  
electronic keypads, card readers, and other dual devices  
15 wherein a key and some other identifying device or process  
is required. A user might be required to insert a magnetic  
card or press in a keypad identification number, before  
using his key.

All electronic identification locks possess  
20 disadvantages in that such locks fail to operate when power  
is not present, and identification codes may be observed by  
unauthorized persons as the code is being entered.

The prior art includes a lock actuated by keys which  
are provided with light actuated means indicating

authorization or lack thereof. Such locks are illustrated in United States Patent Nos. 3,733,862 and 4,996,514.

Others have introduced mechanical locks, with position switches attached, the disadvantage being that only a few  
5 electronic identification means may be provided.

~~Devices constructed in accordance with the invention overcome these and other disadvantages by providing encoded keyed alike keys with a lock capable of identifying which of these keys is operating the lock.~~

10 Accordingly, it is an important object of this invention to provide a lock which will operate for any person having possession of one of many keys fitting a particular lock pattern as selected for the lock. Each key has a different identification code made possible by an  
15 arrangement of notches on the key. Thus, the assigned possessor of the key may be identified when the key is used in the lock.

Another important object of the invention resides in the fact that even in the event of complete loss of power,  
20 the lock will still operate, although it will be unable to identify the assigned possessor of the key.

## Summary of the Invention

A key configured in both a conventional manner to operate a mechanical lock and in a predetermined pattern of notches and the like when inserted into the lock and turned,  
5 either blocks or allows light beams to pass to light

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detection circuitry capable of reading the pattern of the  
notches to identify the particular key being used in the  
lock. The detected pattern of blocked or non-blocked light  
beams is decoded into a key identification number or symbol.

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10 Thus, the method contemplates providing keyed alike keys for operating a lock, and encoding said keys with a pattern of notches indicating which of the keyed alike keys is used in operating the lock.

## Brief Description of the Drawings

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

5       The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

10       Figure 1 is a perspective view illustrating a storage box containing a stored key having a lock and key access constructed in accordance with the invention mounted on the window of an automobile;

Figure 2 is a longitudinal sectional elevation taken on the line 2-2 in Figure 1;

15       Figure 3 is a perspective view illustrating a lock and access key arrangement mounted as in Figures 1 and 2 together with sensor mechanism for determining the identity of the access key;

20       Figure 4 is a transverse sectional elevation taken on the line 4-4 in Figure 3;

Figure 4-A is a transverse sectional elevation similar to Figure 4 but illustrating the lock with the access key in unlocked position;

Figure 5 is a schematic perspective view illustrating

the access key and related parts of the lock; and

Figure 5-A is a schematic side elevation illustrating mechanism for actuating detection circuitry.

## Description of a Preferred Embodiment

The drawings illustrate a lock having a cylinder housing, and a cylindrical plug for receiving an access key in an elongated axial slot. The lock is shown positioned for securing a drawer of storage box A in closed position.

A plurality of spaced apertures in the plug permit the passage of light therethrough. Light passage means in the

cylinder housing permit the passage of light to the spaced

apertures in the plug. A plurality of encoded access keys B

each have at least one notch arranged therein to permit the passage of light through a predetermined opening in the plug. The key excludes the passage of light through another predetermined opening in the plug. The notches are arranged to encode information indicating which person or persons selected from a larger group of authorized persons is identified with each key. A light sensor receives the information encoded in the predetermined arrangement of notches when a key is inserted into the slot in the plug for actuating the lock.

Figures 1 and 2 illustrate a storage box A positioned upon the glass 10 of the window of an automobile 11 by suspending it upon a clip 10a. The box A is illustrated as including an abutment 12 which projects inwardly to provide a stop for locking a cam 13 carried by the cylindrical plug



14 of the lock against forward movement which would permit opening of a drawer 15. The lock is carried in the slidable drawer 15 within the lock box A for storing a desired article such as an operating key 15a for the respective automobile upon which the box is carried. If desired, another suitable access means or closure such as a hinged door and the like may be utilized for blocking access to a storage device.

~~An access key B is illustrated in Figure 5 as having a~~  
10 shank with a guiding groove 16. The access key is notched or provided with serrations including projections 17 along one edge in a conventional manner. Such an access key cooperates in a tumbler type lock so that the notches and intervening projections 17 operate the usual tumblers  
15 permitting rotation of the plug 14. The spine 18 of the shank of the key is illustrated as being notched as at 19 in a pattern to cooperate with suitable multiple bores or other aperture means 20 in the lock body or housing 21.

When an inserted key has serrations correctly matching  
20 suitable tumblers, the plug may be rotated about its axis. A cam 13 or other locking arm or device, is attached to the plug, causing locking and unlocking or some other desired function when the plug is rotated. The body or housing 21 retains the plug and houses suitable tumblers (not shown)  
25 and their associated parts.

A series of passages or apertures 20 is formed in the body 21 of the lock and a series of openings 22 are placed in the plug so that when the plug is rotated in the body to an actuating position, the light passages in the plug and the light passages in the body line up so that in the absence of any intervening or masking key material, light may pass through the light passages or other suitable openings in the body of the lock, through the spaced light passages or apertures in the plug, and on out through to the other side of the lock.

The notches are illustrated as being in the spine of an access key inserted in the lock and turned from the locked position as illustrated in Figure 4 to the actuated position as in Figure 4-A to provide a pattern of open and blocked passages that is decoded into a key identification signal. A series of light emitters or sources 24, provided with power through the plug or connector 30 from the batteries or other power source 31 (Figure 2), are placed so that their emitted light passes into the apertures and openings on one side of the lock.

A series of light detectors 25 are placed on the other side of the lock such that, in the instance of an open passage, light from the emitter falls on a respective detector. The light emitters and light detectors are illustrated in Figure 3 as positioned upon opposite legs of

a mounting bracket 32. In the case of the absence of a notch in the key, causing the light to be blocked, the light from an emitter will not fall on the respective detector.

This pattern of passed and blocked light is received by  
5 suitable detection circuitry illustrated in Figure 5 at 26 for use in amplification and other desirable conditioning of the signal for use by suitable decoding circuitry 27 if  
necessary. The decoding circuitry is connected through the

plug 30 (Figure 4) or connector to yield an identification  
10 symbol or number useful by a computer 33 (Figure 5) and the like to display or record indicating the identity of the person operating the access key. The limit of identification numbers or symbols is controlled as a binary function of the number of passages in the lock body. Four  
15 passages would yield sixteen possible symbols while eight passages would yield two hundred fifty-six possible symbols. Some of the identification bits could be used for parity or error checking for correction, and others, specifically the all light blocked and all light passed conditions could be  
20 interpreted as not allowed states. These two particular identifications could relate respectively to an unencoded key and a possible lock picking attempt. Suitable electronics may be used to sound an alarm, make notification, or record of the event. Figure 1 illustrates  
25 a plurality of such keyed alike access keys (B) having like

10

projections 17. Each key B is encoded with a distinctive pattern of notches 19 for passing light to detectors 25 when in alignment with the apertures in the lock.

An additional light emitter and light detector pair 28  
5 and 29 respectively may be used to detect actuation of the lock. Light from the emitter is reflected from the cam as the lock cylinder or plug is rotated as illustrated in Figures 3 and 5-A. Reflected light is picked up by the  
light detector 29 which actuates a suitable electrical  
10 signal indicating that the lock has been opened. This device may act, for example, as a power saver when associated with the detection or other circuitry, not shown, as a means for actuating same, permitting the other circuitry to remain in a dormant state or state of reduced  
15 activity, until needed.

If desired, other forms of sensing or detecting means for sensing the pattern of the notches and the like by which the access keys are encoded may be provided. Mechanical switches which may be actuated by the presence or absence of  
20 a notch or suitable magnetic effect devices and photo-resistive materials may be provided opposite a suitable switch operator for sensing or reading the pattern or code on this key.

It is thus seen that a keyed alike lock with multiple  
25 key identification capabilities has been provided. The lock may be a conventional mechanical tumbler lock operated by a

key. The key is encoded preferably by providing a spine of the key fitted with notches. Several light beams are directed through holes in the body of the lock toward several photo-detectors. Some of the beams are blocked by the spine of the key where no notches are present. Other beams are allowed, by the presence of a notch, to pass to the photo-detectors. The photo-detected pattern of present or blocked light beams which is decoded identifies the key being used to operate the lock and such information may be utilized as by a computer.

While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

What is Claimed Is:

1. A device for the storage of operating keys  
comprising:

a closure restricting access to an operating key;

5 a lock carried by said closure limiting access to  
said operating key to a group of authorized persons each  
possessing an access key having similar serrations along one  
edge thereof;

~~means for encoding each access key to permit or to~~

10 restrict the passage of light in a predetermined pattern  
indicating which person or persons of said group of  
authorized persons is identified with each access key when  
opening said lock;

a source of light;

15 a sensing means receiving light passing said key  
reflecting the identity of said person or persons;

means indicating the identity of said person or  
persons accessing said device and the operating key therein;  
and

20 said serrations on each access key opening said  
lock.

2. In a lock having a cylinder housing, and a  
cylindrical plug for receiving a key in an elongated axial  
slot carried in said cylinder housing, the improvement

comprising:

a plurality of spaced apertures in said plug  
permitting the passage of light therethrough;

means in said cylinder housing for supplying light  
5 through said spaced apertures in said plug;

a plurality of keys each having therein a  
~~predetermined pattern of at least one notch to permit the~~  
passage of light through an aperture in said plug;

~~each of said keys excluding the passage of light~~  
10 through another aperture in said plug;

said predetermined pattern encoding information  
indicating the identity of the key distinguishing it from a  
larger number of keys which are also capable of opening the  
lock; and

15 a light sensor receiving said information encoded  
in said predetermined arrangement [of notches] when a key is  
inserted into the slot in said plug.

3. A combined mechanical lock and key identifying  
mechanism comprising:

20 a key operated mechanical lock having a body;  
spaced passages in said body;

a key for operating the mechanical lock, the key  
having a predetermined pattern of notches therealong  
reflecting the identity of the key distinguishing it from a  
25 larger number of keys which are also capable of opening the

lock;

a light source projecting a beam of light into  
said passages in said body of the lock so as to pass through  
said notches in the key and be blocked by said key where

5 there is no notch in a pattern;

detectors sensing presence of light beams in said

pattern; and

a decoder for identifying the light beams so

sensed.

10 4. The mechanism set forth in claim 3 including means  
signaling when said lock is open.

5. The mechanism set forth in claim 3 including a  
movable reflective member carried by said lock and a  
detector receiving light from said reflective member  
15 signaling actuation of the lock.

6. The mechanism set forth in claim 3 wherein said  
predetermined pattern is located along a spine of said key.

7. A closure for the storage of operating keys  
comprising:

20 a receptacle in said closure for containing an  
operating key;

a lock carried by said closure limiting access  
therethrough to a group of persons;

means for encoding each of a plurality of access  
25 keys, each having similar serrations along one edge thereof,  
indicating which predetermined person or persons selected



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from said group of persons is possessed of each key;

a sensing means receiving a signal from said means for encoding each of said plurality of access keys indicative of the identity of said person or persons;

5 means for indicating and recording the identity of said person or persons accessing said operating key responsive to said signal; and

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said serrations on each of said access keys

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opening said lock.

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10 ~~8. In a lock having a cylinder housing, and a~~

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cylindrical plug for receiving a key in an elongated axial slot carried in said cylinder housing, the improvement comprising:

a plurality of spaced openings in said plug;

15 a plurality of keys each having therein a predetermined pattern of at least one notch to permit the passage of a signal producing means through a predetermined opening in said plug, said pattern encoding information;

each of said keys excluding the passage of a  
20 signal producing means through another predetermined opening in said plug; and

a sensor receiving said information encoded in said predetermined pattern of notches when a key is inserted into the slot in said plug.

25 9. A combined mechanical lock and key identifying

mechanism comprising:

a key operated mechanical lock having a body;

a key for operating the mechanical lock;

5 a pattern of notches along said key reflecting the  
identity of the key distinguishing it from a larger number  
of keys which are also capable of opening the lock;

means producing a signal responsive to said

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notches in the key reflecting said pattern of notches;

detectors sensing presence of said signal; and

---

10 a decoder for identifying the signal so sensed.

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10. The mechanism set forth in claim 9 including means  
signaling whether or not a particular key is legal or  
illegal.

11. The mechanism set forth in claim 9 wherein said  
15 notches are spaced along a spine of said key.

12. The method of securing an enclosure comprising the  
steps of:

providing a lock for said enclosure operated by  
any one of a plurality of keyed alike keys;

20 encoding each of said keyed alike keys by  
providing a distinctive pattern of notches on each of said  
keys for identifying each key;

sensing said pattern of notches on one of said  
keys as it is used in said lock; and

25 decoding said pattern of notches sensed on said

one of said keys;

whereby one can distinguish which particular key is being used so as to know who is gaining entry into said enclosure.

5           13. The method set forth in claim 12 including utilizing a source of light for sensing said pattern of notches.

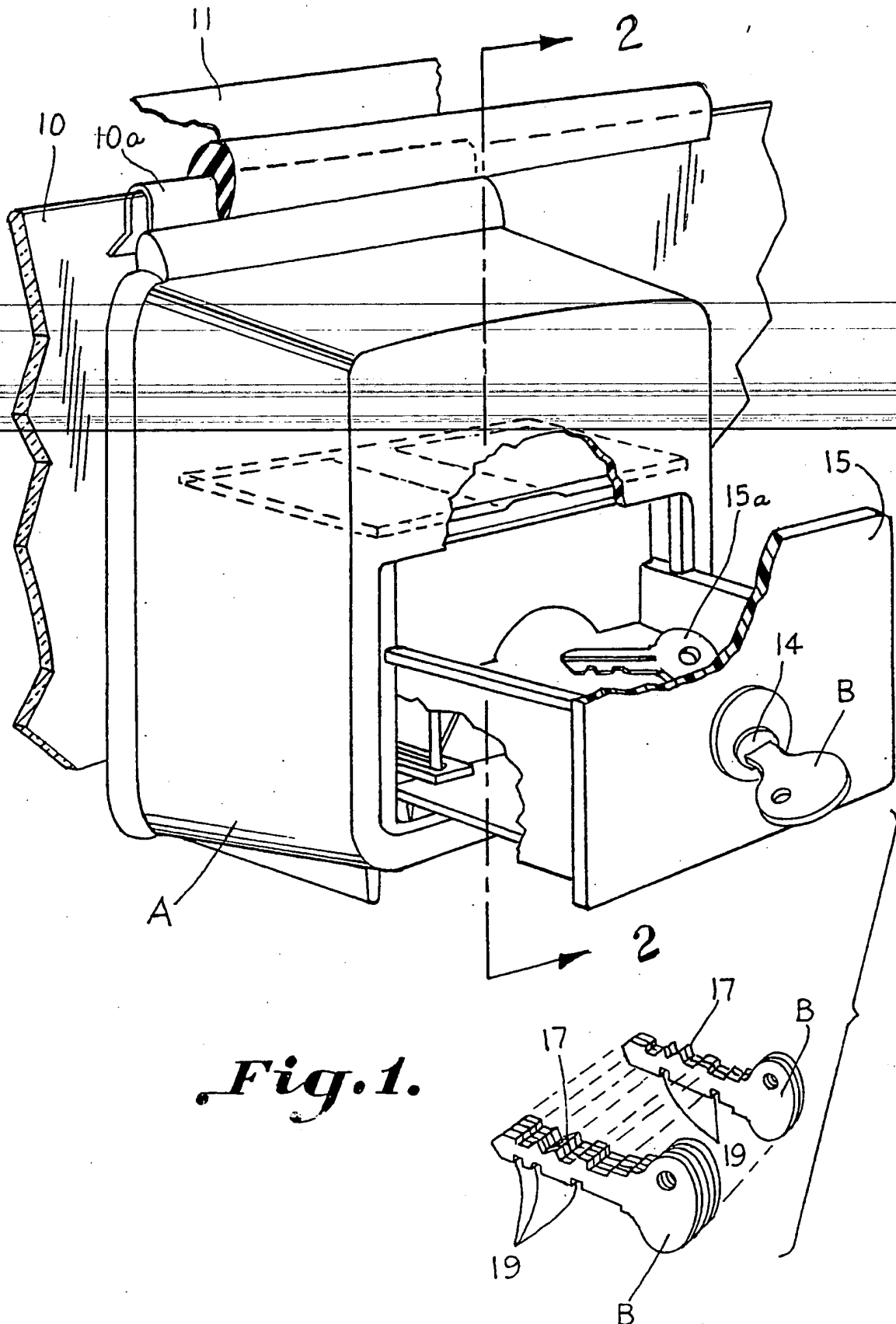
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14. The method set forth in claim 13 including  
providing a receptacle for an automobile key in said

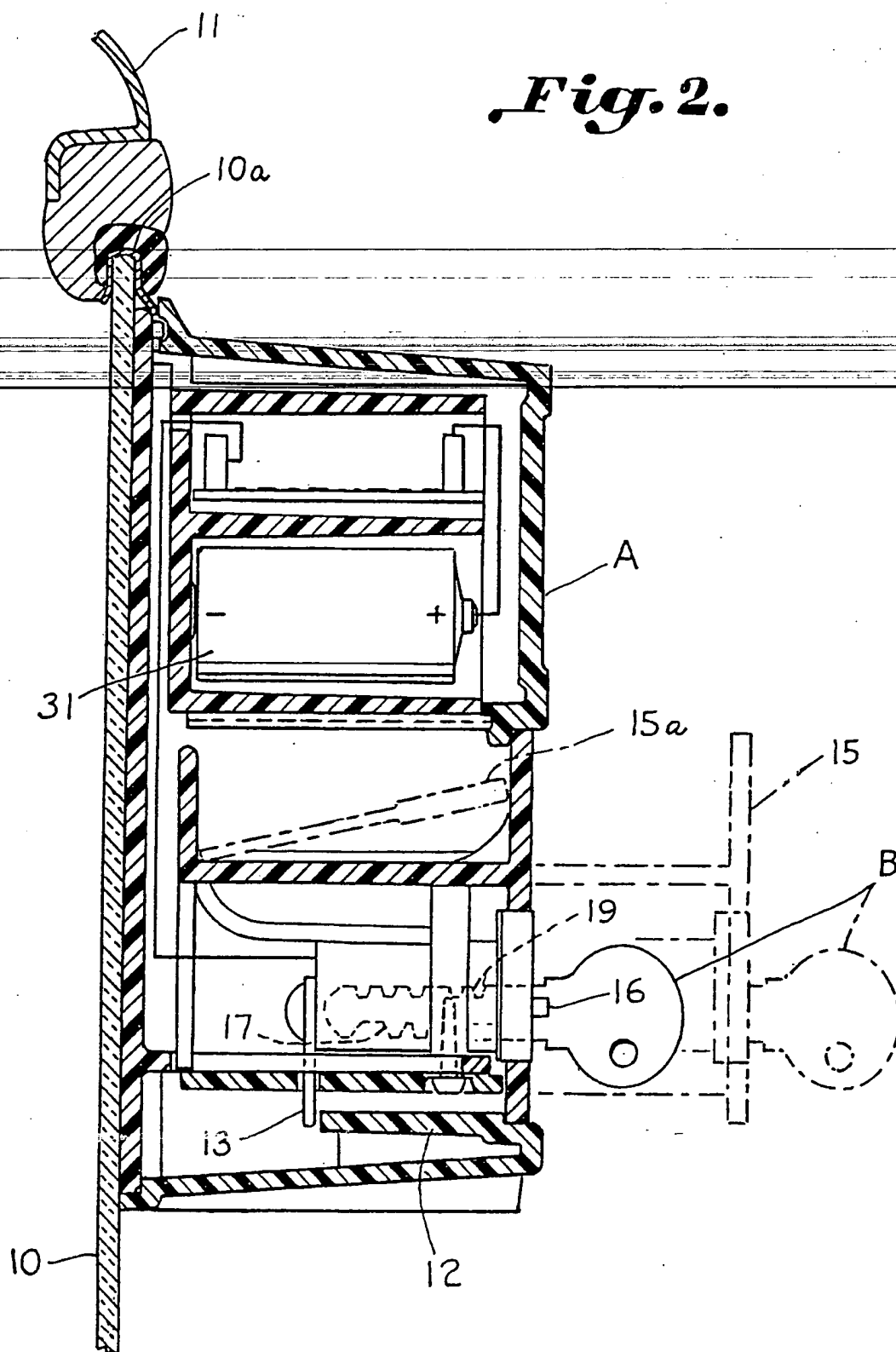
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10       enclosure, and attaching said enclosure to an automobile window.

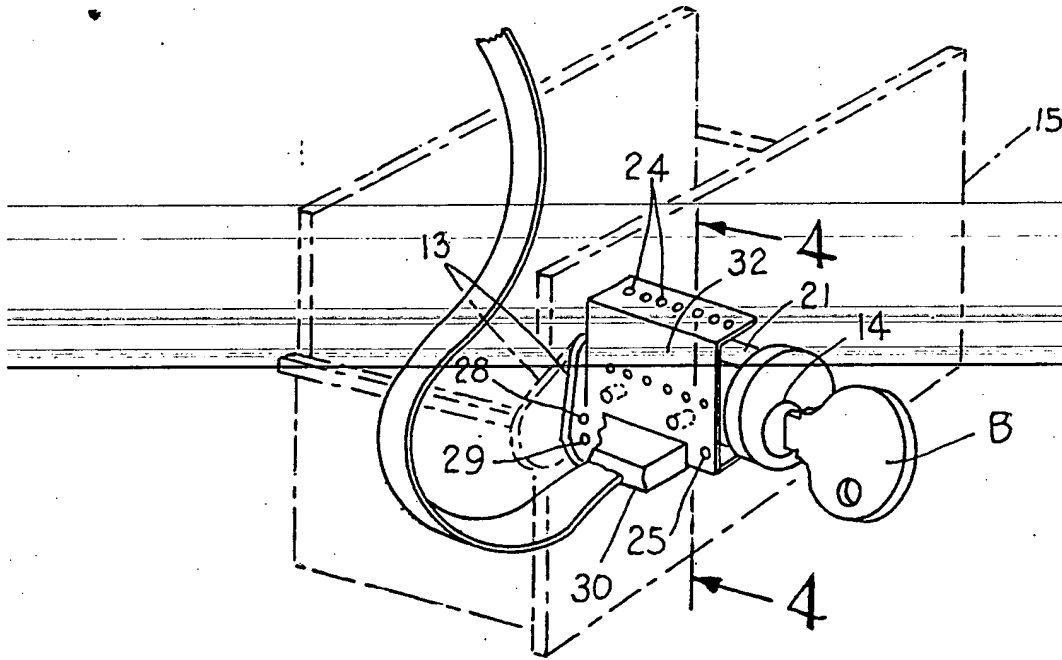
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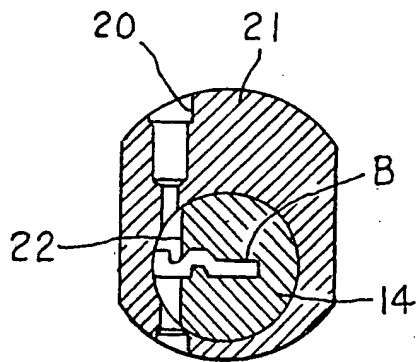
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*Fig. 2.*

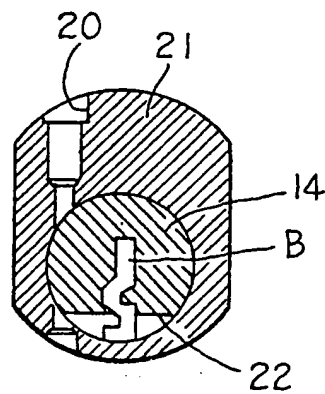
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*Fig. 3.*

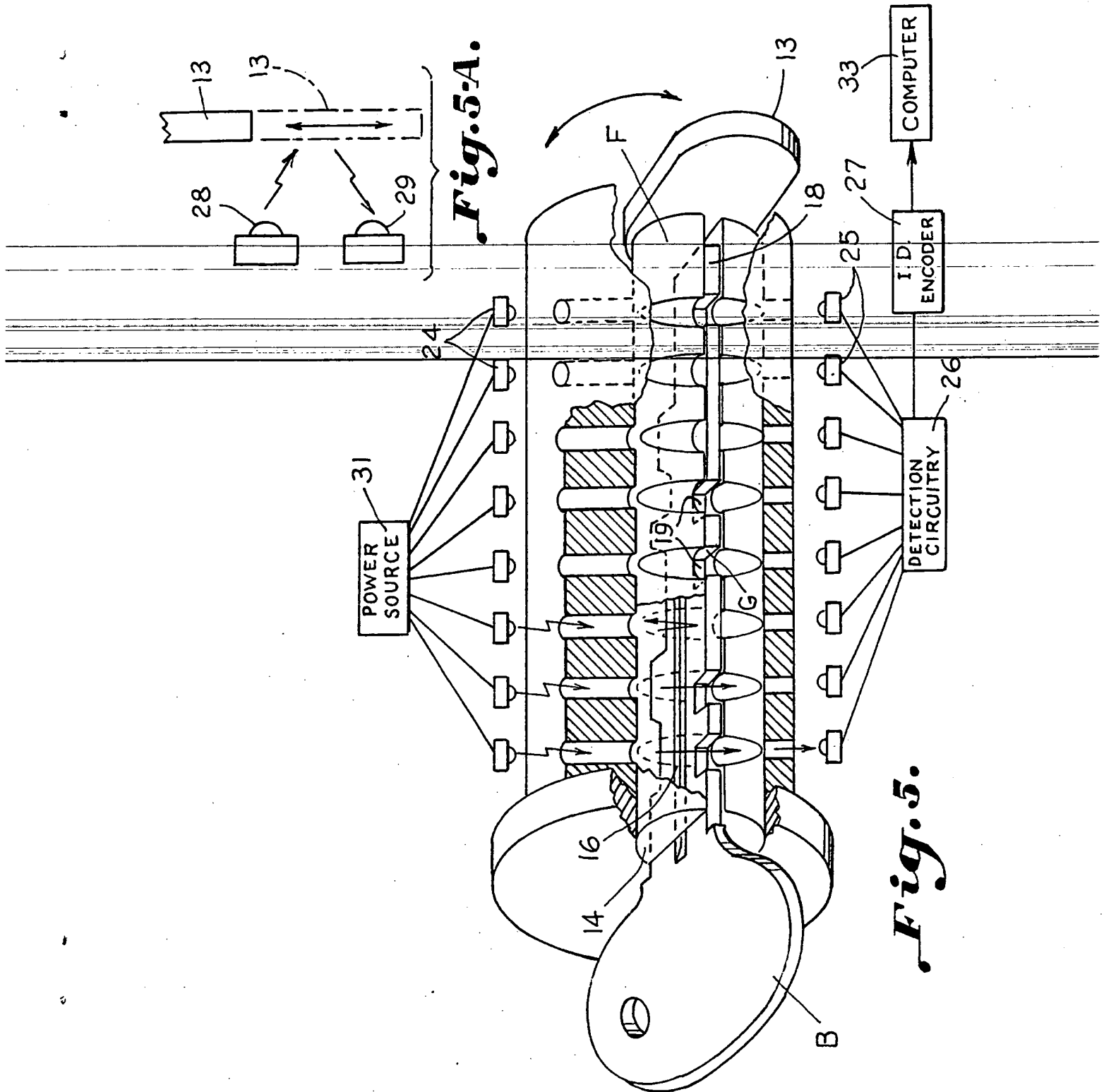


*Fig. 4-A.*



*Fig. 4*

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## INTERNATIONAL SEARCH REPORT

PCT/US92/10589

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : E65D 55/14; E05B 49/02

US CL : 70/63, 278, DIG.51

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3,889,501 (FORT) 17 June 1975. See Fig. 2.	2-4, 6, 8-13
Y		1, 5, 7, 14
Y	US, A, 4,656,851 (LEEK ET AL.) 14 April 1987. See Fig. 3a.	5
Y	US, A, 3,742,741 (CAHAN) 03 July 1973. See Fig. 2.	1, 7, 14
Y	US, A, 3,093,994 (RICHARD) 18 June 1963. See col. 1, lines 45-51.	1, 7
A	US, A, 3,733,862 (KILLMEYER) 22 May 1973. See Fig. 4.	1-14
Y	CH, A, 597,478 (Zeiss) 14 April 1978. See Abstract	1, 7

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3,902,342 (ZUCKER ET AL.) 02 September 1975. See Fig. 1.	1-14
A	US, A, 4,090,175 (HART) 16 May 1978. See Fig. 9.	1-14
A	US, A, 4,369,481 (EARLY) 18 January 1983. See Fig. 1.	1-14
<del>A</del>	<del>US, A, 4,996,514 (SUNAMI) 26 February 1991. See Fig. 1</del>	<del>1-14</del>

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